Dynamic Pricing in the Food & Beverage Industry

Principles & Practical Implementation

Sébastien Fauvel

CEO & Data Science Consultant
Darwin Pricing LLC

About Darwin Pricing LLC

Dynamic Pricing and **Data Science Consulting** since 2013

- 2013: **Geo-Pricing Solution** used by over 900 online retailers, mostly in the US market
- 2016: **Start-Up** founded in Basel. Exhibitor at the **Web Summit** in Lisbon. Investment by the **Swiss Startup Factory** in Zurich.
- 2017: **Dynamic Pricing Solution** of the **OTTO Group** in Hamburg (€ 3 bn/yr), focus on fashion and sporting goods, profit and stock optimization as well as competition analysis
- 2018: **Dynamic Pricing Platform** for **Hachmeister+Partner** in Bielefeld, focus on fashion & sport in fashion stores, used by **Hagemeyer** in Minden and **L&T** in Osnabrück (6 stores)
- 2019: **Demand Forecasting Solution** of the **H&M Group** in Stockholm (€ 20 bn/yr) for fashion retail

Food Retail: Challenges for Grocery Stores

- ★ **Shifting consumer behaviors**
  - ⇨ No planning security
- ★ **Perishable products**
  - ⇨ Coping with stock surplus and stock shortage
- ★ **Limited storage capacities**
  - ⇨ Liquidation costs and waste management

Goals of Dynamic Pricing

Automated, proactive price adjustments during the product lifespan. Business goals:

- Maximizing total revenue and net profits while reducing waste
- Permanent articles: Avoiding selling off before the next planned goods receipt
- Seasonal articles: Selling off at the highest possible calculation until the end of the season
- Early detection of stock surplus, shortages and range of coverage and proactive price adjustments
- Generating strong revenues from selling off remaining stocks and avoiding liquidation costs

Digitalizing Price Tags

Operationalizing dynamic pricing in grocery stores:

- ★ Hardware investment (price tags, WiFi)
- ★ Process adjustments (POS system)
- ★ Central price management, online/offline synchronization

Dynamic Pricing Process

Core piece of the dynamic pricing system: Sales forecasting

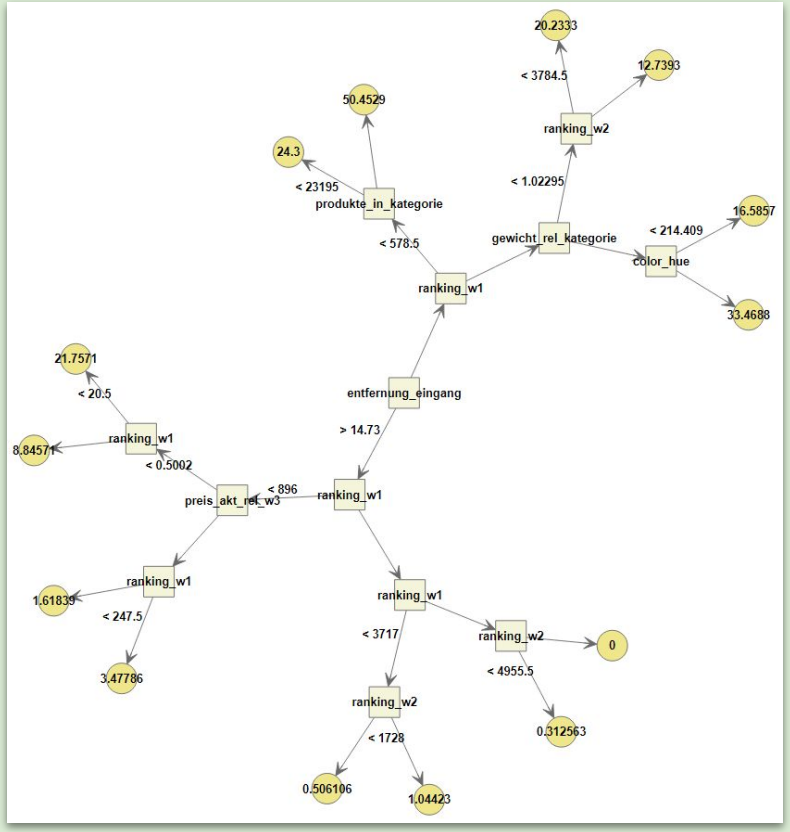
- How did prices impact purchasing behavior in the past few months and years?
- Daily forecast for every article, depending on prices, competition, inventory and seasonality
- Projection until best-before date of each article, taking into account stocks and seasonality curve
- KPI computation for revenue and net profits until end of the product lifespan
- Determination of the optimal price list using cannibalization-aware algorithms
- Update of digital price tags overnight, possibly after manual approval
- Price corrections as needed within the product lifespan

Sales Forecasting with Boosted Trees

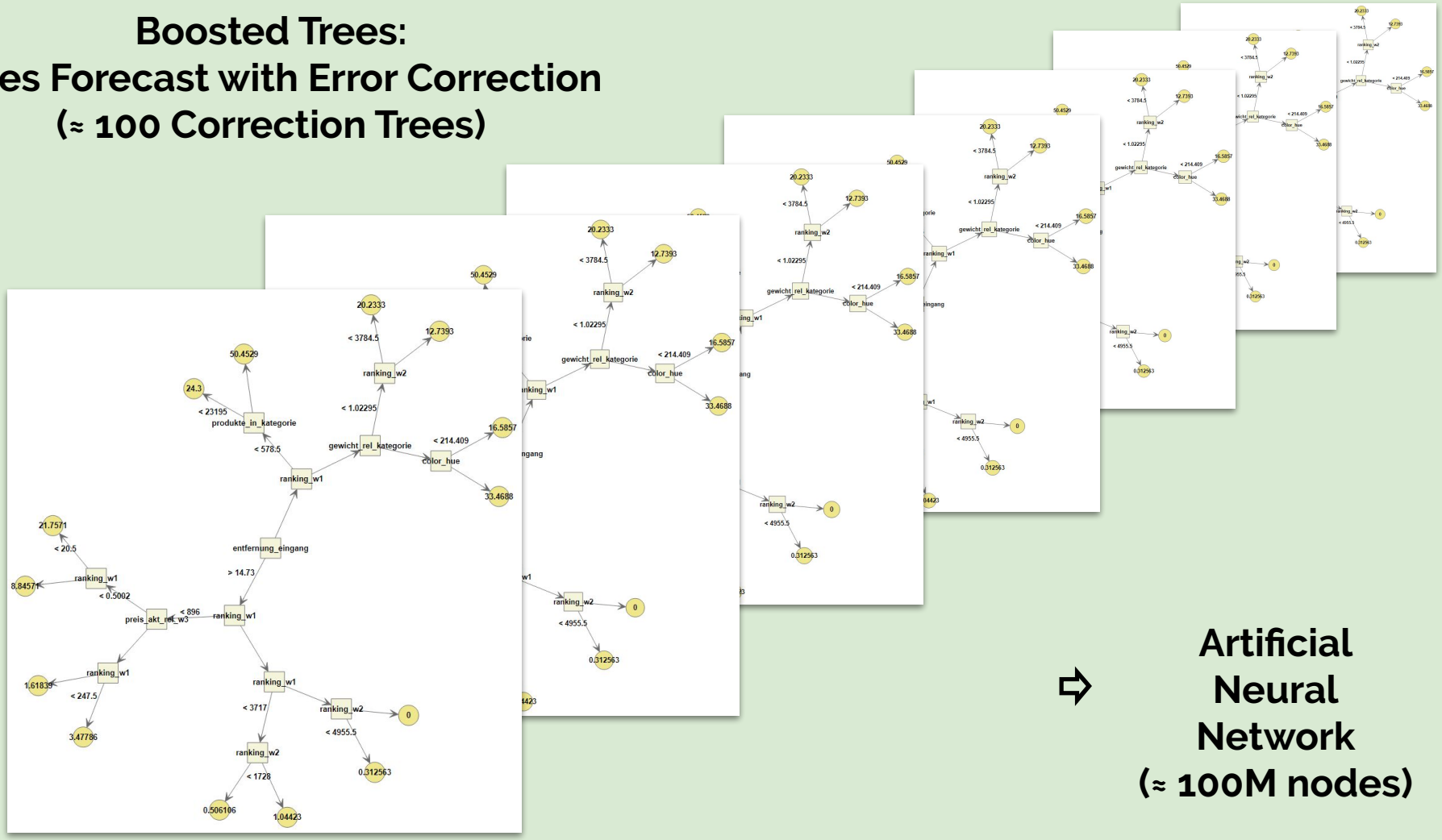
Relevant Features for Sales Forecasting

- Tops/Flops Analysis: Ranking of the best selling brands and products
- Placement: Distance to the store entrance, showcase products, position in search lists (online), ...
- Promotions: Price changes in the last few weeks, promotional discount offers, catalogue products, ...
- Characteristics: Product type, labels, weight, color (hue, saturation, brightness), size, quantity, …
- Classics: Since how long a product has been introduced into the assortment
- Sellout: Stocks and availability in retail stores
- Seasonality: Sales figures during the previous year for the same product category in the same store
- Price, profit margin: Determination of the price elasticity for each product
- Relative price: Competitor prices and cannibalization by substitutable articles in your own assortment

Decision Tree:
Product Characteristics ⇨ Sales Forecast
(≈20 Decision Steps)



Boosted Trees:
Sales Forecast with Error Correction
(≈ 100 Correction Trees)



⇨ **Artificial Neural Network (≈ 100M nodes)**

Prerequisites

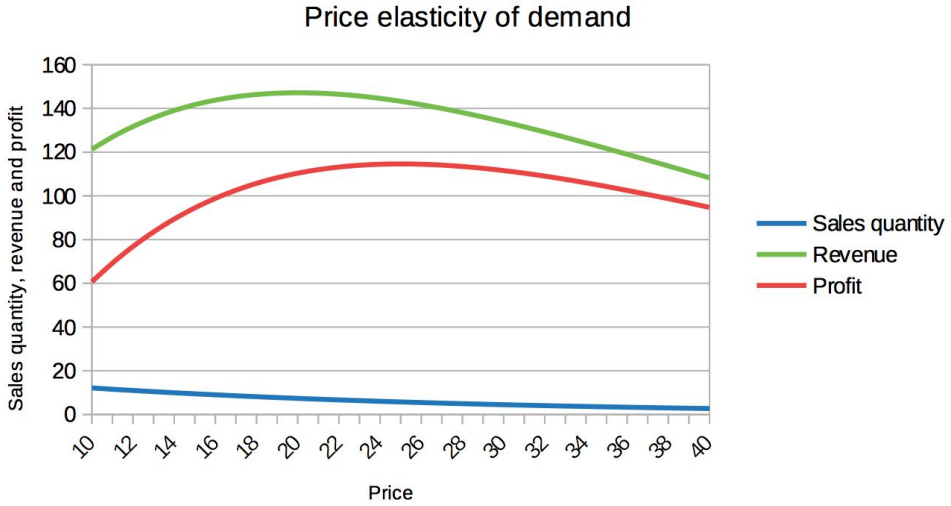
Quality and quantity of the underlying data are decisive for sales forecasting.
Better data ⇨ More accurate sales forecast ⇨ Best results and stable prices

- Relevant product details: Category, brand, size, origin, labels, weight, quantity, ...
- Current and historical sales data: Assortment, prices, stocks and sales numbers on a daily basis
- Optionally weather and competitor data, brand and market trends...
- Recommended retail prices, purchasing costs, shipping and return costs, rebates and discounts, ...
- Best-before date of each article and delivery dates for stock optimization
- Liquidation costs for remaining stocks

Price Elasticity

For the sake of transparency of our price recommendations, we are displaying the price elasticity curve of each article (sales quantity vs. price) as well as the corresponding KPIs revenue and net profit:

Burger Patties
5,95 €



Business Rules

Further pricing policies can be defined and adjusted in a flexible way depending on the current operative situation:

- Minimal price: e.g. purchase price plus VAT, or a minimal calculation for each brand
- Uniform prices: e.g. all product sizes for the same price, or same prices in all physical stores
- Price ladders: e.g. price changes in 1 € steps only for articles in the price range ±10 €
- Update frequency: e.g. no more than one price change a week for each article
- Price lock: e.g. no price changes on product launch or for specific brands
- Market prices: e.g. prices within a ±20% price corridor around main competitor prices

Benefits of Dynamic Pricing

Reaching the same business goals in a more efficient and reliable way:

Dynamic Pricing:

- Systematic, comprehensive
- Controlled, data driven
- Proactive, predictable
- Considers a number of factors: Demand, seasonality, stocks, delivery dates, best before dates, revenue, calculation, net profits...

Manual Pricing:

- Punctual, seldom
- Gut feeling, personal experience
- Reactive, hectic
- Addresses problems one at a time: Calculation, purchase frequency, customer acquisition, seasonal sales, clearance...

Thanks for your attention!

Time for Questions & Answers

Sébastien Fauvel

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sebastien.fauvel@darwinpricing.com